AF/2127 /IRW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Arndt**

Serial No.: **09/589,795**

Filed: **June 8, 2000**

For: **Logical Partitioning Via Hypervisor Mediated Address Translation**

§ Group Art Unit: **2127**
§
§ Examiner: **Vo, Lilian**
§
§ Attorney Docket No.: **AUS9-2000-0220-US1**
§

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By: Amelia C. Turner
Amelia C. Turner

TRANSMITTAL DOCUMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:
ENCLOSED HEREWITH:

- Appellant's Brief (in triplicate) (37 C.F.R. 1.192); and
- Our return postcard.

A fee of $330.00 is required for filing an Appellant's Brief. Please charge this fee to IBM Corporation Deposit Account No. 09-0447. No additional fees are believed to be necessary. If, however, any additional fees are required, I authorize the Commissioner to charge these fees which may be required to IBM Corporation Deposit Account No. 09-0447. No extension of time is believed to be necessary. If, however, an extension of time is required, the extension is requested, and I authorize the Commissioner to charge any fees for this extension to IBM Corporation Deposit Account No. 09-0447.

Respectfully submitted,

Duke W. Yee
Registration No. 34,285
YEE & ASSOCIATES, P.C.
P.O. Box 802333
Dallas, Texas 75380
(972) 367-2001
ATTORNEY FOR APPLICANT

Docket No. AUS9-2000-0220-US1 *PATENT*

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ATTENTION: Board of Patent Appeals and Interferences

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By: Amelia Turner
Amelia C. Turner

APPELLANT'S BRIEF (37 C.F.R. 1.192)

This brief is in furtherance of the Notice of Appeal, filed in this case on June 21, 2004.

The fees required under § 1.17(c), and any required petition for extension of time for filing this brief and fees therefore, are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief is transmitted in triplicate. (37 C.F.R. 1.192(a))

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REAL PARTIES IN INTEREST

As reflected in the Assignment recorded on June 8, 2000, at Reel 010869, Frame 0045, the present application is assigned to International Business Machines Corporation, the real party in interest.

RELATED APPEALS AND INTERFERENCES

With respect to other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal, there are no such appeals or interferences.

STATUS OF CLAIMS

Claims 1-19 stand finally rejected as noted in the Final Office Action mailed May 6, 2004.

STATUS OF AMENDMENTS

Applicants' Response to Office Action, mailed on February 2, 2004, has been entered. Applicants have not filed a response to the Final Office Action.

SUMMARY OF INVENTION

Applicant's independent claims describe mediating address translation in a logically partitioned data processing system having a set of logical partitions. An operating system is assigned to each logical partition. A different contiguous range of virtual address pages of virtual addresses is associated with each one of these logical partitions. A noncontiguous group of page

frames of real memory addresses is assigned to each one of the contiguous range of virtual address pages. Each one of the set of logical partitions is assigned a different group of page frames. A request to access a physical resource is received from an operating system that is within a logical partition. An address translation table is selectively modified to allow access to the physical resource by the operating system responsive to a determination that the physical resource has been allocated to the logical partition that includes the operating system that sent the request.

Applicant's dependent claims describe refraining from modifying the address translation table responsive to a determination that the physical resource is allocated to a different partition.

Applicant's claim 19 describes a plurality of operating systems. Each operating system is assigned to one of a plurality of logical partitions. A different contiguous range of virtual address pages is associated with each one of the logical partitions. A noncontiguous group of page frames of real addresses is assigned to each one of the virtual address pages. Each logical partition is assigned a different noncontiguous group of page frames. Each one of a plurality of physical resources is assigned to one of the logical partitions. A mediating component is included that provides address translation between each virtual address belonging to one of the operating systems and a corresponding one of the physical addresses that belongs to one of the physical resources. The mediating component determines whether a requested resource has been allocated to a requesting operating system before mapping a virtual address to a physical address. If the requested resource has not been allocated to the logical partition that includes the requesting operating system, the mediating component refrains from mapping the virtual address to the physical address that belongs to the requested resource.

ISSUES

Is the Examiner's rejection of claims 1-19 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,684,974 issued to *Onodera* well founded?

GROUPING OF CLAIMS

For the purposes of this appeal, claims 1-19 stand or fall together as one group.

ARGUMENT

The Examiner rejected claims 1-19 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,684,974 issued to *Onodera*. This position is not well founded.

Onodera teaches two embodiments. The first embodiment describes converting an access to a logical storage area into an access of a real memory storage area. The second embodiment describes a procedure for changing the contents of an entry in an address reconfiguration array in order to connect or disconnect an already existing logical storage area assignment to a real address entry in the address reconfiguration array.

Applicant claims receiving from an operating system a request to access a physical resource. The operating system is within a particular logical partition. Responsive to a determination that the physical resource has been allocated to the particular logical partition that includes the requesting operating system, an address translation table is modified to allow access to the physical resource by the operating system. Applicant also claims responsive to a determination that the physical resource is allocated to a different logical partition other than the particular partition, refraining from modifying the address translation table.

Applicant claims a request to access a physical resource. *Onodera* teaches a request to access logical memory, not a request to access a physical resource. *Onodera* teaches, at column 10, lines 47-50, "an LIP makes a request to access its contiguous LMS". The LMS is the logical storage. The LIP is a processor. Thus, *Onodera* teaches a processor making a request to access logical storage. This is not a request to access real storage. This is not a request to access a physical resource. This is a request to access logical storage. Therefore, *Onodera* does not anticipate Applicant's claims because *Onodera* does not teach a request to access a physical resource as claimed by Applicant. *Onodera* teaches a request to access logical storage, not a physical resource.

Applicant claims receiving from an operating system a request to access a physical resource. Thus, Applicant claims an operating system making the request. *Onodera* teaches a processor making a request, not an operating system. Nothing in *Onodera* teaches an operating system making the request to access memory. *Onodera* teaches that the memory access request is made by the LIP which is the logical instruction processor. See column 8, lines 28-33.

A processor can be said to be executing low-level firmware, an operating system, or an application. *Onodera* does not teach what the processor (LIP) is executing. *Onodera* teaches a processor making a memory access request. *Onodera* does not teach an operating system making the request.

The Examiner states that *Onodera* teaches this feature at column 7, lines 25-29 and lines 37-41, column 8, lines 22-52, and figures 5 and 7. These parts of the reference teach converting a memory access that is to logical storage into a memory access that is to real storage. Thus, the request was a request to access logical storage. The request was not a request to access real storage. Because *Onodera* does not teach an operating system making the request, *Onodera* does not anticipate Applicant's claims.

Applicant claims the operating system being within a particular logical partition. Applicant also claims responsive to a determination that the physical resource has been allocated to the particular logical partition that includes the operating system, an address translation table being modified to allow access to the physical resource by the operating system. The Examiner states that *Onodera* teaches this feature at column 7, lines 25-29 and lines 37-41, column 8, lines 22-52, and figures 5 and 7. This section of *Onodera* describes converting a memory access that is to logical storage into a memory access that is to real storage. *Onodera* does not teach a determination that the physical resource has been allocated to the particular logical partition that includes the operating system.

Applicant claims determining that the physical resource has been allocated to the logical partition that includes the operating system that made the request to access the physical resource. In *Onodera*, each entry in an address reconfiguration array includes a validity flag and a real address entry. For each entry, the validity flag indicates whether the real address portion of the entry is valid. If the validity flag has a "valid" value, the flag indicates that the contents of the real address portion of the entry are valid. If the validity flag has an "invalid" value, the flag indicates that the contents of the real address portion of the entry are invalid. According to *Onodera*, if the validity flag indicates that the real address portion of the entry is invalid, this "implies that either no storage segment of the RMS [real memory] is allocated to the logical storage area of the LMS [logical storage] being accessed or the storage segment of RMS is in an off-line state". Column 11, lines 54-58.

Applicant claims a determination of an allocation of a physical resource to a particular logical partition. This particular logical partition is the one that includes the requesting operating system. This section of *Onodera*, however, does not teach determining whether a physical resource has been allocated to a logical partition that includes a particular operating system. This section teaches determining whether an allocation exists between real memory and logical storage. This section of *Onodera* does not teach determining whether a physical resource has been allocated to a logical partition that includes the particular operating system that made the request to access the physical resource.

Onodera teaches, in its second embodiment, that an assignment of a logical storage area to a real address entry can be connected and disconnect using a validity flag. Each entry in the address reconfiguration array includes a real memory address and a validity flag. This validity flag can be used to indicate that the real address portion of the entry is either valid or invalid. If the flag indicates that the real address portion is valid, a connection is made. If the flag indicates that the real address portion is invalid, a disconnection is made. This connection or disconnection is made between a logical storage and an address entry of real memory that had already been allocated to the logical storage. This preexisting allocation is either connected or disconnected. Therefore, the validity flag is not used to determine whether a physical resource is allocated to a logical partition, the validity flag is used to determine whether a preexisting allocation is currently valid, i.e. connected.

Applicant claims modifying the table to allow access in response to a determination that the physical resource has been allocated to the logical partition. Thus, according to Applicant, if the physical resource is allocated to the logical partition that includes the operating system that made the request, the table is modified to permit access. The second embodiment of *Onodera* teaches connecting and disconnecting preexisting allocations. The second embodiment does not teach modifying a table when a determination is made that the physical resource is allocated to a logical partition that includes an operating system that made the access request.

Applicant teaches that a request to a physical resource is made, a determination that the physical resource has been allocated is made, and then an address translation table is modified. These features are executed in a particular order. *Onodera* teaches that a request to a logical resource is made, a determination step is completed next, a modification step is then completed to modify the address reconfiguration array, and then a request is made to a physical resource.

Applicant teaches a combination of features that occurs in a particular order. Even if the Examiner is correct and *Onodera* teaches the individual features claimed by Applicant, *Onodera* does not teach the particular order of the features.

In *Onodera*, the request to a physical resource is made last, after a determination step and after a modification step. In Applicant's claims, a request to a physical resource is made first. Then, a determination is made that the physical resource has been allocated to the logical partition that includes the operating system that made the request. Responsive to this determination, the table is modified.

Onodera teaches a request being made to access a real address at step 909. See Column 12, lines 16-18. This request is made after the validity flag is checked. Thus, a determination has already been made that the real address in the entry is valid. This request is not made before a determination is made as to whether the physical resource has been allocated to the logical partition that includes the operating system that made the request. This request is made after a determination is made that the validity flag is valid. Thus, when the request to access a real address is made, a determination has already been made that the real address is allocated to the logical address to which a request was made. Applicant teaches a determination step that occurs after a request to access a physical resource is made. *Onodera* does not anticipate Applicant's claims because *Onodera* does not teach the order of execution being a request to a physical resource, a determination that the physical resource has been allocated, and then an address translation table being modified.

Applicant also claims responsive to a determination that the physical resource is allocated to a different logical partition other than the logical partition that includes the requesting operating system, refraining from modifying the address translation table. The Examiner states that the Abstract and column 5, line 64, through column 6, line 20 teach these features. This section of *Onodera*, however, teaches refraining from modifying an entry in the address reconfiguration array when the real address entry is invalid. This is not what is claimed by Applicant. Applicant claims refraining from modifying the table when the physical resource is allocated to a different partition. According to Applicant, this partition is not the partition that includes the operating system that made the request to access the physical resource. Therefore, *Onodera* does not anticipate Applicant's claims because *Onodera* does not teach responsive to a determination that the physical resource is allocated to a different logical partition other than the

particular partition, refraining from modifying the address translation table.

Applicant's claims are patentable over the cited prior art. The combination of references does not describe teach or suggest a request to access a physical resource by an operating system, a determination that the physical has been allocated to the logical partition that includes the requesting operating system, the combination of first making a request to access the physical resource, then making the determination and thereafter modifying an address translation table, or responsive to a determination that the physical resource is allocated to a different logical partition other than the particular partition, refraining from modifying the address translation table.

Lisa L.B. Yociss
Reg. No. 36,975
Yee & Associates, P.C.
PO Box 802333
Dallas, TX 75380
(972) 367-2001

APPENDIX OF CLAIMS

The text of the claims involved in the appeal reads:

1. A method for mediating address translation in a logically partitioned data processing system having a set of logical partitions with an operating system assigned to each logical partition within the set of logical partitions, the method comprising:

associating a different contiguous range of virtual address pages of virtual addresses with each one of said set of logical partitions;

assigning a noncontiguous group of page frames of real memory addresses to each one of said different contiguous range of virtual address pages, each one of said set of logical partitions being assigned a different noncontiguous group of page frames;

receiving from an operating system within a logical partition from the set of logical partitions a request to access a physical resource;

responsive to a determination that the physical resource has been allocated to the logical partition, selectively modifying an address translation table to allow access to the physical resource by the operating system.

2. The method as recited in claim 1, further comprising:

responsive to a determination that the physical resource is allocated to a different logical partition in the set of logical partitions, refraining from modifying the address translation table.

3. The method as recited in claim 2, further comprising:

sending a message to the operating system indicating that the request is denied.

4. The method as recited in claim 1, wherein the address translation table comprises a table of virtual addresses with corresponding physical addresses, wherein the virtual addresses are addresses utilized by the operating system and the physical addresses are addresses corresponding to the physical location of resources within the logically partitioned data processing system.

5. The method as recited in claim 4, wherein the physical addresses are allocated to various ones of multiple logical partitions in a disjoint fashion.

6. The method as recited in claim 4, wherein consecutive virtual addresses need not correspond to consecutive physical addresses.

7. A computer program product in a computer readable media for use in a logically partitioned data processing system for mediating address translation in a logically partitioned data processing system having a set of logical partitions with an operating system assigned to each logical partition in the set of logical partitions, the computer program product comprising:

instructions for associating a different contiguous range of virtual address pages of virtual addresses with each one of said set of logical partitions;

instructions for assigning a noncontiguous group of page frames of real memory addresses to each one of said different contiguous range of virtual address pages, each one of said set of logical partitions being assigned a different noncontiguous group of page frames;

instructions for receiving from an operating system within a logical partition from the set of logical partitions a request to access a physical resource;

instructions, responsive to a determination that the physical resource has been allocated to the logical partition, for selectively modifying an address translation table to allow access to the physical resource by the operating system.

8. The computer program product as recited in claim 7, further comprising:

instructions, responsive to a determination that the physical resource is allocated to a different logical partition in the set of logical partitions, for refraining from modifying the address translation table.

9. The computer program product as recited in claim 8, further comprising:

instructions for sending a message to the operating system indicating that the request is denied.

10. The computer program product as recited in claim 7, wherein the address translation table comprises a table of virtual addresses with corresponding physical addresses, wherein the virtual addresses are addresses utilized by the operating system and the physical addresses are addresses corresponding to the physical location of resources within the logically partitioned data processing system.

11. The computer program product as recited in claim 10, wherein the physical addresses are allocated to various ones of multiple logical partitions in a disjoint fashion.

12. The computer program product as recited in claim 10, wherein consecutive virtual addresses need not correspond to consecutive physical addresses.

13. A system for use in a logically partitioned data processing system for mediating address translation in a logically partitioned data processing system having a set of logical partitions with an operating system assigned to each logical partition in the set of logical partitions, the system comprising:

a different contiguous range of virtual address pages of virtual addresses being associated with each one of said set of logical partitions;

a noncontiguous group of page frames of real memory addresses being assigned to each one of said different contiguous range of virtual address pages, each one of said set of logical partitions being assigned a different noncontiguous group of page frames;

first means for receiving from an operating system within a logical partition from the set of logical partitions a request to access a physical resource;

second means, responsive to a determination that the physical resource has been allocated to the logical partition, for selectively modifying an address translation table to allow access to the physical resource by the operating system.

14. The system as recited in claim 13, further comprising:

third means, responsive to a determination that the physical resource is allocated to a different logical partition in the set of logical partitions, for refraining from modifying the address translation table.

15. The system as recited in claim 14, further comprising:

fourth means for sending a message to the operating system indicating that the request is denied.

16. The system as recited in claim 13, wherein the address translation table comprises a table of virtual addresses with corresponding physical addresses, wherein the virtual addresses are addresses utilized by the operating system and the physical addresses are addresses corresponding to the physical location of resources within the logically partitioned data processing system.

17. The system as recited in claim 16, wherein the physical addresses are allocated to various ones of multiple logical partitions in a disjoint fashion.

18. The system as recited in claim 16, wherein consecutive virtual addresses need not correspond to consecutive physical addresses.

19. A logically partitioned data processing system, comprising:

a plurality of operating systems executing within the logically partitioned data processing system, each of the plurality of operating systems assigned to one of a plurality of logical partitions;

a different contiguous range of virtual address pages of virtual addresses being associated with each one of said set of logical partitions;

a noncontiguous group of page frames of real memory address being assigned to each one of said different contiguous range of virtual address pages, each one of said set of logical partitions being assigned a different noncontiguous group of page frames;

a plurality of physical resources, each assigned to one of the plurality of logical partitions; and

a mediating component for providing address translation between each of a plurality of virtual addresses belonging to various ones of the plurality of operating systems and a corresponding one of a plurality of physical addresses belonging to various ones of the plurality of physical resources; wherein

the mediating component determines whether a requested resource has been allocated to a requesting one of the plurality of operating systems before mapping a one of the plurality of virtual addresses to a one of the plurality of physical addresses belonging to the requested resource; and

if it is determined that the requested resource is not allocated to the logical partition to which the requesting one of the plurality of operating systems is allocated, the mediating component refrains from mapping the one of the plurality of virtual addresses to the one of the plurality of physical addresses belonging to the requested resource.